

Some underutilized indigenous timber trees with high medicinal values: Its challenges and prospects

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Abstract

Underutilized species is referred to species to which little or no attention is paid by the policymakers, agricultural researchers, and plant breeders. Medicinal plants used in traditional medicine have a natural origin, are effective, and less expensive. Traditional doctors in African countries make use of plants in treating millions of people. *Albizia zygia*, *Alstonia boonei*, *Tetrapleura tetraptera*, *Newbouldia laevis* and *Canarium schweinfurthii* are the underutilized indigenous timber trees with high medicinal value that were discussed. Different parts of these trees like the bark, root, leaves, flower, stem, gum are used as medication in treating diverse diseases such as painful urination, epilepsy, convulsion etc. This study aims at reviewing the underutilized indigenous timber trees with high medicinal values, their challenges, and prospects. Methods are derived to increase the value chain of underutilized timber trees which can contribute to the livelihoods of smallholder farmers and other stakeholders mainly through income generation.

Keywords: Timber; Ethnomedicine; Underutilized; Economic value; Forest

1. Introduction

Nigerian forests are endowed with biodiversity (flora and fauna). Forest and trees contribute to food security and nutrition. They play a vital role in the lives of many people, there are many uses gotten from tree products such as fodder, fibers, fuels, medicine, and the use of wood for construction, fencing, and furniture [1]. It provides a safety net when crops fails when means of livelihood are challenged by economic, political, and environmental difficulties which make local people turn to forest resources for diet and income [2]. Some forest products like timber, charcoal, craft, firewood, and tree products such as fruits, nuts, oil, vegetables, and medicine generate incomes. These forest incomes contribute to the livelihood of those in the rural communities in developing countries [3]. Underutilized trees are tree species considered to be less important because of their consumption, utilization, and production which are not well exploited. However, in other to add value to man and the economy, certain areas like medicine, industry, and agriculture are meant to be totally explored to eradicate poverty and hunger [4]. Timber is a natural material processed from trees. Over the years, it is used for different purposes and it is one of the oldest natural resources. It is a construction material used for ornamental and structural purposes all over the world [5]. There are up to 200,000 hardwood species and 1000 softwood species in Nigeria, only 2,300 of these species are commercially important [6]. It possess some good characteristics, a timber can split, bend, twist, shrink, and translucent. Various timbers have different properties; some are heavy, hard, soft, light, brittle, and flexible while some timbers burn more readily than others [7]. Forest industries, smallholders, stakeholders, and agricultural firms utilize some very important timber species such as *Acacia mangium*, *Paraserienthes falcataria*, *Swietenia macrophylla*, *Dalbergia latifolia*, *Tectona grandis*, *Azadirachta indica*, *Khaya*

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senegalensis and *Mansonia altissima*. Some attributes of these species include their propagation, management, germplasm, and their current market demand. The wood properties of these utilized species are promoted by development organizations, government, and non-government organizations. However, underutilized species are generally less researched, and abandoned because they have not been commercially exploited. They are usually found in the wild forest and they can be grown as scattered trees in the garden [8]. Timber can be grouped into physical, mechanical, and seasoning properties. The physical property of timber consists of specific gravity and density. The mechanical properties determine the strength of the timber, while the seasoning properties determine its durability, elasticity, and strength by reducing the moisture content [9]. Timber is known as the wood used for joinery, carpentry, reconverted for manufacturing purposes, building materials. It is commonly used for walls, roofs, and floor frames [10]. The strength of each timber relies on the species; the effect of some growth characteristics and these characteristics varies [11]. The aim of this review is to explore some of the underutilized tree species with great medicinal potentials thereby focusing on some of the challenges hindering them and their future prospects.

1.1. Distribution and occurrence of the selected underutilized indigenous timber trees

The five selected indigenous timber trees occur in different regions and have diverse distribution. For instance,

Albizia zygia (DC.) J.F.Macbr. is a medium sized semi-deciduous tree that is widely grown in tropical Africa and grows up to 30m high [12]. It belongs to the Leguminosae-Mimosoideae family which is usually found in Gabon, Cameroon, Ghana, Kenya, Nigeria, Sudan, Tanzania, Uganda, and Republic of Congo. The plant has several names in different regions; in Nigeria, Igbo's call it (Nyie avu), Yoruba's call it (Ayunre), Swahili as (Nongo), and the Akans in Ghana call it (Okuro). The wood is used for veneer and plywood, boat and shipbuilding, indoor construction, vehicle bodies, and tool implements like pestle, and hoe-handles.

Alstonia boonei De Wild is a tropical plant grown in several parts of Africa and south Asia; it is a large deciduous tree up to 45m tall belonging to the Apocynaceae family. It is commonly known as "ogbu-ora" by the Igbo tribe, "ukhu" by Hausa people and "ahun" in the Yoruba tribe of Nigeria [13]. The wood is used for construction and carving. It is known as a good source of timber that can be exported.

Tetrapleura tetraptera (Schumach. & Thonn.) Taub is a robust perennial and deciduous tree of 20 to 25m in height. The plant has grey-brown color with smooth-rough bark. It has four longitudinal wing-like pods nearly 3cm broad. The generic name comes from a Greek word meaning 'four ribs' referring to the ribbed fruit. The specific epithet means four-winged [14]. The plant belongs to the family of Fabaceae -Mimosoideae and a native to Africa [15]. *T. tetraptera* is known to be nutritious. The fruits are used in the cooking of soup, porridge for nursing mothers to get rid of postpartum contraction. It also helps in managing leprosy, convulsion, rheumatism, and inflammation [16]. The heavy and hardwood of this species are used for carving, the building poles, tool handles, and pestles [17].

Newbouldia laevis (P. Beauv.) Seem is commonly known as a Boundary tree or Tree of life. It can be found in tropical Africa, with a height up to 7-8 meters. It belongs to the Bignoniaceae family [18] and widely distributed across west and central Africa. It is also recognized in African folk medicine in treating cough, treating sexually transmitted diseases, breast cancer, constipation, fever, stomach ache, and toothache [19]. *N. laevis* is known for its medicinal value as anti-microbial, antioxidant, anti-inflammatory, wound healing properties, analgesic, and anti-fungi [20-21]. Different names are attributed to this plant by various tribes, in Hausa as (Aduruku), Yoruba as (Akoko), Igbo as (Ogirisi) and Edo as (Ikhimi) [22]. The wood is used for making boundaries [23].

Table 1 Overview of the five selected underutilized indigenous timber species.

Scientific Name	Family	Common Names
<i>Albizia zygia</i>	Fabaceae (Mimosoideae)	Silk tree or Siris
<i>Alstonia boonei</i>	Apocynaceae	God's tree or Stool wood [28].
<i>Tetrapleura tetraptera</i>	Fabaceae – Mimosoideae	Aidan tree or Gum tree
<i>Newbouldia laevis</i>	Bignoniaceae	Boundary tree or "Tree of Life" [29].
<i>Canarium schweinfurthii</i>	Burceraceae	Africa Elemi

Canarium schweinfurthii Engl. is a big tree with a straight and long bole of 50m or more. It is widely spread around Africa [24]. It belongs to Burceraceae family and commonly found in large quantities in Pankshin, Plateau State of Nigeria. Its

fruiting period is usually between April to September. The fruits are of two varieties with different shapes, short round and long spiral shape from which flowers develop. The flower has a dark green color and gets clustered at the end of the twig [25]. Different products are derived from *C. schweinfurthii* which are timber, medicine, fuelwood, gum and resin. The wood is used for decorative veneers, plywood, joinery, parquetry, and furniture components [26]. Pulp and seeds of the fruit are a good sources of vitamin C, used as a flavor in non-beverages and snacks [27].

2. Benefits associated with the five selected indigenous timber trees

The listed underutilized timber species have diverse medicinal potentials. However, necessary attention was not given in terms of policies that would tackle the multifaceted problems affecting their effective use. These tree species has diverse use aside been used as timber. Some of these benefits are discussed below:

2.1. Ethno-medicinal uses

Medicinal plants are the main sources of many drugs in the modern world and the majority of the indigenous medicinal plants are used as food and spices. These medicinal plants are of utmost importance to the health of people and their communities. Plant parts such as leaf, flower, fruit, seed, tuber, and root are used for different medicinal purposes. They have some physiological component which has been exploited by traditional medical practices in treating a diverse ailment [30]. Ethno medicine is the application and the use of phytomedicine by native people of different ethnic origin. All over the world, various cultures depend on indigenous medicinal plants as the first need for their primary health [31]. Traditional medicine has become important and is globally known, it has been researched that 25% of modern medicines are derived from plant tested and used by traditional medical practitioners [32].

In Africa, the medicinal potentials of plant medicine are well known by the rural dwellers [33]. Indigenous knowledge of the medicinal plant by indigenous people is to use plants to maintain health, improve, prevent, diagnose or treat physical and mental illnesses Medicinal plants are used in treating the spiritual origin of disease and the physical symptom. Medicinal plants have curative properties due to the presence of different compositions of various chemical substances present which are known as the secondary plant metabolites. These secondary metabolites are alkaloids, glycosides, flavonoids, essential oils etc.

Table 2 Ethnomedicinal uses of various parts of the selected timber species

Scientific name	Plant part	Disease conditions treated with the medicinal plants
<i>Albizia zygia</i>	Root	The ground root is added to food to treat Cough and as an expectorant [12].
	Stem	The methanol stem bark extract of <i>A. zygia</i> is a painkiller [34] and is also potent against <i>Plasmodium falciparum</i> K1 strain and <i>Trypanosoma brucei rhodesiense</i>
	Leaves	Leaves and stem are used in the treatment of boils, diarrhoea, male sexual impotence, oedema, and fracture [35].
	Bark	The bark is used as an antidote, aphrodisiac, purgative, stomachic, and vermifuge.
<i>Alstonia boonei</i>	Root	The root is used for people suffering from rheumatism to relieve rheumatic pain and other types of pains
	Stem	The stem bark is an antivenom for snakebite and also used in traditional medicine to treat painful urination, insomnia, and chronic diarrhea [36].
	Leaves	The leaves are used in reducing any swellings [37].
	Bark	The bark is used in treating measles and snakebite [37].
<i>Tetrapleura tetraptera</i>	Root	Extract of the root is used in treating leprosy and many infectious diseases that affect the arm, legs, skin, and some nerves.
	Stem	The stem and bark can be used for the treatment of hypertension and for checking oxidation levels of hypertensive patients.
	Leaves	The leaves are used in managing convulsion.
	Bark	The bark extract serves as a curative effect on dyslipidemia [38].

<i>Newbouldia laevis</i>	Root	Decoction of the roots with <i>Alstonia boonei</i> , <i>Jatropha curcas</i> are used for treating epilepsy [39].
	Stem	The stem bark decoctions are used for children in treating convulsions, epilepsy etc. [40].
	Leaves	Decoction of the leaves is used in treating sore eye, ear pain [41], used against dental caries [42].
	Bark	The bark is chewed and swallowed for diarrhea, toothache, and pains generally [43].
<i>Canarium schweinfurthii</i>	Root	Roots are used against adenitis
	Stem	The bark of the stem decoction is used as a remedy for stomach pain, colic, and roundworms.
	Leaves	The leaves are used as stimulants against diarrhea, constipation, fever, malaria etc. [44].
	Bark	The bark of <i>C. schweinfurthii</i> is crushed and used for preventing or treating leprosy attack.

2.2. High Economic value

The underutilized timber species holds a great diversity and a vast value of indigenous knowledge. The indigenous timber species contribute to the livelihood and profitability of commercial farmers. The species which are geared to the market will generate cash income and therefore can call on external inputs and the ability of modern technologies to transform plants into various finished products, and their storage life gives chances to use and advertise these products derived from the specie.

2.3. As a construction or landscaping material

Timber, which is also wood is a versatile, flexible, and complex building material for constructing houses, companies, and insulating material and it is quite abundant in Nigeria [45-46]. There is an increase in the request for timber which is unlimited in Nigeria. Preserving woods helps in the durability, and long-lasting of timber by adding chemicals.

3. Challenges affiliated with unplugging the prospect of the selected indigenous timber trees

The challenges promoting underutilized timber species are due to certain factors such as;

3.1. Fund

Lack of funding in the majority of the institutions is a major factor limiting research, sensitization, developments and popularization of underutilized species. The private and public sectors must also contribute to promoting, and developing these plant species [4].

3.2. Marketing and Information of underutilized plant species

Almost all plant species have medicinal value. Information and knowledge about the medicinal and nutritional values of the underutilized plant species are limited. Underutilized plant species have poor marketing because of the inability to afford them, also no knowledge on how to access the location of the plant species. Strong publicity and awareness should be created to market, the underutilized species products for end-users are in order for farmers to also benefit from the sale of the plant species [4].

3.3. Little research and Innovation

Little or inadequate research has been done in harnessing the potential of the underutilized timber trees and there is often incoherent evidence available to support the development of research activities of particular timber trees [47]. This situation could be attributed to a lack of clear research goals and limited innovation.

3.4. Deforestation or illegal felling

Illegal cutting of trees is a common activity and this in no small measure has also contributed to the underutilization of some of our forest timbers. Unemployment rate, food insecurity, and poverty rate, all these are ascribed to the

unselective cutting of trees by the younger ones. Hence, there is a need for investment in the propagation and establishment of plantations for these selected timber trees as well as the enactment and effective implementation of rules and regulations against illegal logging.

4. Prospects of unlocking the potentials in selected indigenous timber trees

The keys to unlock the potentials rest in our ability to harness their multiple uses. The social and economic useful traits present in the underutilized species should receive appropriate attention. The chains linking farmers up to final end-users play a critical role in securing revenues to rural communities and thus fueling the very mechanism that will maintain the diversity of these species in the field.

4.1. Promoting the usage of parts of timber trees for health benefits

In some developing countries, it is noticed that the yardstick for having a stable health is through the use of medicinal plant [48]. Traditional African medicine is the sum of total practices, measures of ingredients with different procedures used by Africans that enable them to guard against disease. Many people use plants with medicinal value as an alternative therapy despite the availability of modern medicine. There is an increase in the use of medicinal plants in the industrialized societies that is traced to the extraction and development of different drugs, as well as chemotherapeutics from such plant and the locally used herbal plants [49].

4.2. Promoting a useful value chain for the selected indigenous timber tree

To promote a successful value chain on the selected underutilized timber trees, some things need to be considered which are; awareness of environmental factors, increased research, addressing challenges, needs and opportunities related to promoting calls for active collaboration with local communities, and mainstreaming gender-sensitive approaches. Organizations of farmers, and traditional seed systems can assist in organizing programs that will promote the effectiveness and relevance of the underutilized species. Development processes, researcher's steps, and stakeholders from smallholder farmers to policymakers must be consulted and must participate in the open processes.

4.3. Application of technologies for the development of selected indigenous timber tree

Provision of modern technological infrastructural amenities which includes state of heart storage facilities, modern processing machinery, and mechanized cultivation tools are all necessary. The advantages of these technologies are taking sustainable renewable resources by changing waste materials into a useful product, and this helps in their durability.

4.4. Encourage collaboration in researching, promoting, conserving and sustainability of underutilized indigenous timber species

The agricultural sector has to identify and recognized the importance of indigenous underutilized timber species so as to conserve and protect the traditional knowledge about them for future generations, thereby, encouraging the farmers to undergo training and other groups along the value chains in managing soil health, producing quality seeds, booking and good marketing [50]. Attention should be given to the underutilized species by researchers to ensure that these species are no longer ignored. Monitoring, documentation on-farm conservation and international policies for trading will help coordinate to promote underutilized species at different areas, and levels. Lack of Interaction across sectors like (agriculture and education) and some other groups like (farmers, researchers, and decision-makers) hinder the potentials of the underutilized indigenous timber species. Collaborative platforms, processes and method that will facilitate strategic synergies among national, regional, and international networks need to be supported and encouraged [50].

5. Conclusion

Forest and trees are important sources of products for people's needs. Exploring the potentials of these selected indigenous timber species are better methods of sustainable development goals. Domesticating, exploring, and commercializing this indigenous timber species can be social, and economically significant. Underutilized indigenous timber species have untapped potential that helps rural communities and small-scale farmers by improving their incomes and medicinal value. Continuous usage of this underutilized timber makes them competitive. The conservation and sustainable use of underutilized indigenous timber species is hampered by inappropriate rural development policies and programs that focus on a limited number of commodities. The use of underutilized timber can alleviate pressure on overexploited timber species, and increase the economic viability of responsible forest management.

Imploring smallholder farmers in rural and urban areas to be aware of the benefits of using the underutilized indigenous species, also policymakers and scientist needs to promote and protect these underutilized species.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest. All the authors consent to the content of the manuscript.

References

- [1] Food Agricultural Organization. Global forest resources assessment: progress towards sustainable forest management. Rome: FAO. 2010.
- [2] Food Agricultural Organization. The state of Food and Agriculture: Better Food Systems for Better Nutrition. Rome. FAO. 2013.
- [3] Bronwen Powell, Amy Ickowitz, Stepha McMullin, Ramni Jamnadass, Christine Padoch, Miguel Pinedo-Vasquez, Terry Sunderland. The role of Forest, Trees and Wild Biodiversity for Nutrition-Sensitive Food Systems and Landscapes. ICN2 Second International Conference on Nutrition better nutrition better lives. 2013; 3-23.
- [4] Lawrence Misa Aboagye, Nelson Obirih-Opareh, Lucy Amissah, Hans Adu-Dapaah. Analysis of existing policies that enable or inhibit the wider use of underutilized plant species in Ghana Council for Scientific and Industrial Research Ghana. Analysis of existing national policies and legislation that enable or inhibit the wider use of underutilized plant species for food and agriculture in Ghana. 2007; 1-30.
- [5] Fuwape JA. Wood utilization from cradle to the grave. Federal University of Technology Akure. Inaugural lecture series. 2000; 25: 1-33.
- [6] Oluyeye AO. Wood: A versatile material for natural development. Inaugural lecture series 45, delivered at the Federal University of Technology, Akure. 2007.
- [7] Jane FW. The structure of wood. Adam & Charles Black Ltd., Soho Square, London, 1962; 427.
- [8] Normah MN. Fruits of tropical climates- lesser known fruits of Asia. In: Encyclopedia of food sciences and nutrition second edition. Academic press, Amsterdam. 2003; 2816.
- [9] Winandy JE. Wood properties. USDA-Forest Service, Forest Products Laboratory, Wisconsin, USA. In: Arntzen, Charles J., ed. Encyclopedia of Agricultural Science. Orlando, FL: Academic Press. 1994; 4: 549-561
- [10] Raw Material Research Development Council of Nigeria. Audit of Indigenous technologies for processing raw material in Nigeria. 1998.
- [11] Yeomans D. Strength Grading of Historical Timbers. Cathedral Communications Limited. 2003. (<http://www.buildingconservation.com/articles/gradingtimbers/gradingtimbers.ht>)
- [12] Apetorgbor MM. "Albizia zygia (DC.) J.F.Macbr," in *Record from PROTA4U*, D. Louppe, A. A.OtengAmoako, and M. Brink, Eds., vol. 2015 of Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale, Wageningen, The Netherlands. 2007.
- [13] Elisabetsky E, Costa-Campos L. The alkaloid alstonine: A review of its pharmacological properties. Evidence-Based Complementary and Alternative Medicine. 2006; 3(1): 39-48.
- [14] Orwa C, Mutua A, Kindt R, Jamnadass R, Simons A. Agroforestry Database: a tree reference and selection guide. Version 4. Agroforestry Database: a tree reference and selection guide. Version 4. 2009.
- [15] Burkill HM. The useful plants of west tropical Africa Royal Botanic Gardens. London. 1995;3:101..
- [16] Nwaichi EO. Effect of heat treatment on the antioxidant properties of *Tetrapleura tetraptera*, *Xylopi aethiopica* and *Piper guineense*. International Journal of Biotechnology and Food Science. 2013; 1(1): 1–5.
- [17] Adetunji J, Aladesanmi. *Tetrapleura Tetraptera*: Molluscicidal Activity and Chemical Constituents. Afri. J. Trad. Complement Altern Med. 2007; 4 (1): 23-36.

- [18] Usman H, Osuji, JC. Phytochemical and *in vitro* *Newbouldia laevis*. African Journal Traditional Compliance and Alternate Medicine. 2007; 4(4): 476-480.
- [19] Arbonnier M. Trees, shrubs and lianas of West African dry zones. CIRAD, Margraf Publishers, GMBH MNHN, Cote d'Ivoire. 2004; 194.
- [20] Chukwujeku JC, Staden JV, Smith P. Antibacterial, anti-inflammatory and antimalarial activities of some Nigerian medicinal plants. SA J Bot. 2005; 71(3&4): 316–325.
- [21] Akerele JO, Ayinde BA, Ngiagah J. Phytochemical and antibacterial and eyes. *Tropical Journal of Pharmaceutical Research*. 2011; 10(2): 211-218.
- [22] Hutchinson J, Dalziel, JM. Flora of West Tropical Africa vol II. London: Crown Agents for Oversea Government and Administration. 1963; 435-436.
- [23] Roger B. The translocation of useful trees in African prehistory. Presented at the 8th International workshop for African Archaeobotany. Modena, Italy, 23-26 June 2015.
- [24] Tchouamo IR, Tchoumboué J, Pinta JY, Njoukam R. L'aiélé (*Canarium schweinfurthii* Engl.): Plante oléagineuse à usages multiples en Afrique. La Rivista Italiana Delle Sostanze Grassa, LXXVII. 2000; 677-680.
- [25] Maduelosi NJ, Angaye SS. Characterization of African Elemi (*Canarium Schweinfurthii*) International Journal of Advanced Research in Chemical Science. 2015; 2(11): 34- 36.
- [26] Chudnoff Martin. Topical Timbers of the World, USDA Forest Service. Ag. Handbook. 1984; 607.
- [27] Anozie EL, Oboho EG. The Effect of Seed Source and Pre-sowing Treatment on Germination of *Canarium schweinfurthii* [Eng] Seeds Asian Journal of Research in Agriculture and Forestry. 2019; 4(4): 1-11.
- [28] Adotey JPK, Adukpo GE, Boahen YO, Armah FAA. Review of the ethnobotany and pharmacological importance of *Alstonia boonei* De Wild (Apocynaceae),” International Scholarly Research Notices. 2012; 9.
- [29] Idu M, Obaruyi GO, Erhabor JO. Ethnobotanical uses of plants among the binis in the treatment of ophthalmic and ENT (Ear, Nose and Throat) ailments. Ethnobotanical Leaflets. 2009; 13: 480-496.
- [30] Ajibesin KK. *Dacryodes edulis* (G. Don) H.J. Lam: A Review on its Medicinal, Phytochemical and Economical Properties. Research Journal of Medicinal Plants. 2011; 5: 32-41.
- [31] Farnsworth N, Akerele AO, Bingel AS, Soejarto DD, Guo Z. “Medicinal plants in therapy,” Bulletin of the World Health Organization. 1985; 63(6): 965–981.
- [32] Cragg G, Newman DJ. “Biodiversity: a continuing source of novel drug leads,” Pure and Applied Chemistry. 2005; 77(1): 7–24.
- [33] Donini A. Humanitarianism, perceptions, power. C Abu-Sada In *In the Eyes of Others: How People in Crises Perceive Humanitarian Aid*. (183–192). New York, NY: Doctors without Borders/Medecins Sans Frontieres (MSF), Humanitarian Outcomes, and NYU Center on International Cooperation. 2012.
- [34] Abere TA, Jesuorobo RI. “Analgesic and toxicological evaluation of the stem bark of *Albizia zygia* Benth (Mimosoideae),” IOSR Journal of Pharmacy and Biological Sciences. 2014; 9(2): 26–31.
- [35] Jiofack T, Fokunang C, Guedje N, Kemeuze V, Fongnzossie E, Nkongmeneck B. Ethnobotanical uses of medicinal plants of two ethno-ecological regions of Cameroon. International Journal of Medicine and Medical Sciences. 2010; 2(3): 60–79.
- [36] Asuzu IU, Anaga AO. Pharmacological screening of the aqueous extract of *Alstonia boonei* stembark, *Fitoter*. 1991; (63): 411-417.
- [37] Maurice M. Iwu. Pharamacognostical profile of selected medicinal plants. Second Edition, Handbook of African Medicinal Plants. CRC Press (Taylor & Francis Group). 2014.
- [38] Bella NM, Ngo LT, Aboubakar OB, Tsala DE, Dimo T. Aqueous extract of prevents hypertension, dyslipidemia and oxidative stress in high salt-sucrose induced hypertensive rats. *Pharmacologia*. 2012; 3: 397-405.
- [39] Adodo A. Nature Power. A Christian Approach to herbal medicine. 3rd edition, Generation press limited Lagos. 2004; 290.
- [40] Tor-anyiin TA, Sha'ato R, Oluma HOA. Ethnobotanical Survey of anti-malarial medicinal plants among the Tiv people of Nigeria. J. Herbs, Spices Med. Plants. 2003; 10(3): 61-74.

- [41] Irvine FR. Woody plants of Ghana. Oxford University Press. London. 1961; 866.
- [42] Okeke AO. Three-minute herbal treatment to reduce dental carries with a *Newbouldia leavis* based extract. *American Journal of Undergraduate Research*. 2003; 2: 1-4.
- [43] Lewis WH. Manony PFE. *Medical Botany; Plants Affecting Man's Health*. JohnWiley and Sons. New York USA. 1977; 240.
- [44] Koudou J, Abena AA, Ngaissona P, Bessiere JM. Chemical composition and pharmacological activity of essential oil of *C. S* Fitoterapia. 2005; 76(7-8): 700-3.
- [45] Aguwa JI. Reliability studies on the Nigerian timber as an orthotropic structural material, Thesis submitted to Department Civil Engineering, Federal University of Technology, Minna. 2010.
- [46] Jimoh AA, Aina ST. Characterisation and Grading of two selected timber species grown in Kwara State Nigeria. *Nigerian Journal of Technonlogy*. 2017; 36(4): 1002–1009.
- [47] Mabhaudhi T, Chimonyo VG, Chibarabada TP, Modi AT. Developing a roadmap for improving neglected and underutilized crops: A case study of South Africa. *Frontiers in plant science*. 2017 Dec 14;8:2143.
- [48] UNESCO, Cultural and Health, Orientation Texts-World Decade for Cultural Development 1988 – 1997. Paris, France: 1996. Document CLT/DEC/PRO -1996. 129.
- [49] UNESCO. FIT/504-RAF-48 Terminal Report: Promotion of Ethnobotany and the Sustainable Use of plant Resources in Africa, Paris. 1998; 60.
- [50] Padulosi S, Thompson J, Rudebjer P. Fighting poverty, hunger and malnutrition with neglected and underutilized species (NUS): needs, challenges and the way forward. *Biodiversity International*, Rome. 2013.